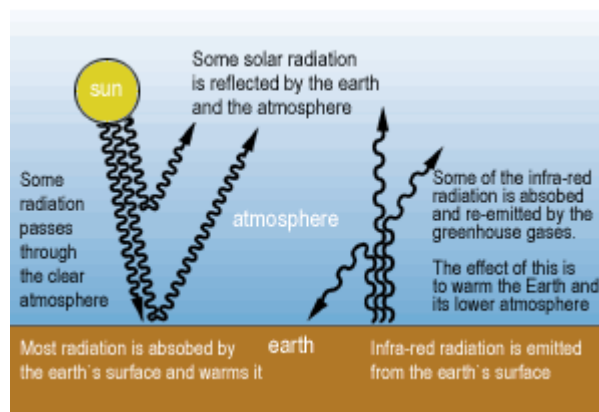


Energy and Greenhouse

The greenhouse effect and its relation to energy production and consumption.

The 'greenhouse effect' refers to the warming of the Earth caused by particular gases in the lower atmosphere.

The Earth's atmosphere has the ability to allow most radiant solar energy to pass through to reach the Earth where it is absorbed, scattered or reflected. Most of this energy is re-radiated as infra-red (heat) energy. The greenhouse gases in the atmosphere absorb some of this heat energy which results in the temperature of the Earth being kept higher than if there was no atmosphere.

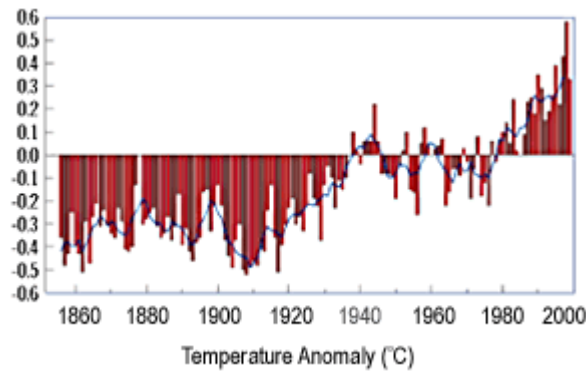


The enhanced greenhouse effect

(Source: Intergovernmental Panel on Climate Change 1990)

Energy production and consumption is directly linked to the greenhouse effect. Over the past 100 years, as the concentration of greenhouse gases has increased, the mean temperature of the Earth has also been steadily rising. This is attributed to what is called the 'enhanced greenhouse effect'. Despite the fact that daily and seasonal temperature swings can be quite significant without causing apparent harm, an overall upward trend in the global average temperature has the potential for significant ecological effects.

The Intergovernmental Panel on Climate Change (IPCC) has found that the mean global temperature has increased by 0.3-0.6°C since the late 19th century. This effect has been slow to appear because only small temperature rises are involved. However, the consequences could be damaging on a global scale.



Global mean temperature (land and sea),
1856-1999 (anomalies relative to 1961-90)

In 1995, the IPCC concluded that 'the balance of evidence suggests a discernible human influence on global climate'. More recently, scientific findings by the CSIRO, indicate that the enhanced greenhouse effect is now impacting on global temperatures. Climate scientists believe that we are beginning to see consequences of global warming. The evidence cited includes the retreat of glaciers, the reduction in the area of the Antarctic ice shelf and changes in the temperatures of the Pacific Ocean.

In summary, the amount of greenhouse gases in the atmosphere regulates the Earth's temperature and therefore climatic conditions.

Which are the greenhouse gases?

The main greenhouse gas is water vapour. This is the most abundant and dominant greenhouse gas, however, human activity has not had any significant direct impact on its concentration in the atmosphere. The enhanced greenhouse effect attributed to human activity is caused by increases of the following gases.

Carbon dioxide

Carbon dioxide is released as a result of burning oil, gas, coal, wood and organic waste for energy. It is also generated by land clearing activities and in chemical processes. The concentration of CO₂ has risen 30% over the last 200 years and makes the biggest contribution to the enhanced greenhouse effect (64%).

Methane

Methane is the main constituent of natural gas and makes the next biggest (20%) contribution to global warming. It is released into the air when plant or animal matter decomposes, such as in a tip or land fill and also as part of the digestive processes in cattle. Small amounts of methane are released during coal mining, and may also leak out of faulty gas appliances or gas pipelines.

Nitrous oxide

Nitrous oxide is released by industrial processes, the burning of vegetation and during soil cultivation and the use of agricultural fertilisers. Small amounts are also released when fuels such as coal and gas are burned in air.

Halocarbons including CFCs (chlorofluorocarbons)

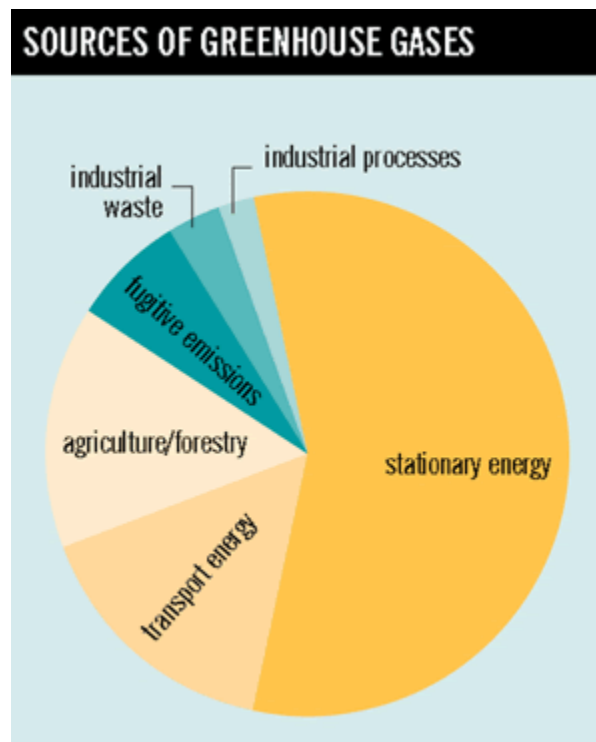
Halocarbons have been used for many years in air conditioners and refrigerators, and have primarily been responsible for the breakdown of the ozone layer as well as contributing to the greenhouse effect. These gases have been phased out of all new cooling equipment but remain in use in older equipment where they can gradually leak out through deteriorated seals.

Energy types and greenhouse gas emissions

Because various fuels contribute differing amounts to greenhouse gas emissions, schools can reduce their contribution to global warming by choosing the most appropriate energy type for each application. The table below indicates the differing contribution to greenhouse gas emissions. These greenhouse coefficients are used in the Energy Smart Schools spreadsheet to calculate the greenhouse gas emissions attributed to your school.

Energy type	kg/unit measure	kg/Mj
Electricity	1.3 kg/kWh	0.342 kg/Mj
Natural Gas	2.3 kg/cu.m	0.063 kg/Mj
LPG	1.7 kg/litre	0.067 kg/Mj
Heating oil	2.9 kg/litre	0.075 kg/Mj

The last column highlights that electricity use leads to the highest emissions of greenhouse gases. This is because, in Victoria, most electricity is generated by burning brown coal, which releases a great deal of carbon dioxide for each unit of electricity produced. There are also many losses in this process and in transmitting electrical energy to the consumer. Sources of greenhouse gases



In 1998 Australia's net greenhouse gas emissions (excluding land use changes) totalled 455.9 million tonnes, 13% more than in 1995. Emissions from energy sources contributed 79.6% of these greenhouse gases.

Clearly, energy use is the single major source of greenhouse gas emissions and any improvement in energy efficiency will result in a reduced contribution to global warming.

Carbon dioxide production results from the combustion of any fossil fuel. It is estimated that Victorian schools contribute about 360 000 tonnes of greenhouse gas emissions annually from direct energy use. Mostly this is a result of the burning of fossil fuels directly to produce heat or for electricity production.